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Benefits related to water quantity, water quality, and reduced salt loadings are major factors in the onfarm salinity control projects. Completed reports indicate onfarm irrigation efficiency improvements and salinity control practices will reduce salt loads by 19,000 tons per year in Moapa Valley and by as much as 335,000 tons per year in Lower Gunnison. Table I-1 shows the salt load reductions and salinity concentration reduction impacts at Imperial Dam for six onfarm salinity control projects. USDA has not recommended a plan for the Big Sandy unit because of the continued off-farm salinity control investigations and studies being conducted by the Bureau of Reclamation (BR).

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Irrigation Unit Areas	Salt Load Reduction (Tons)	Reduced Salinity Concentration (mg/L)
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Moapa Valley (NV)	19,000	2
Lower Gunnison (CO)	335,000	35
Virgin Valley (NV, AZ)	37,000	4
McElmo Creek (CO)	38,000	4
Big Sandy (WY)	No Recommended Plan	
Total	735,000	79

These reductions provide significant water quality benefits based upon $561,000 average annual downstream damages for each mg/L increase in salinity concentration at Imperial Dam.

The major benefits from the CRBSCP are international, national, and regional in scope. The international and national need is to maintain the salinity differential in the Colorado River water delivered to Mexico in accordance with the 1973 agreement (Minute No. 242 of the International Boundary and Water Commission, United States and Mexico). The regional need is to maintain current salinity levels in Colorado River water withdrawn for downstream use while allowing the Basin States to further develop its compact-apportioned waters.

8/8/91

United States
Department of
Agriculture

Soil
Conservation
Service

Washington, D.C.

in consultation
with

USDA Salinity Control
Coordinating Committee

1983 Annual Report Colorado River Basin Salinity Control Program

FOREWORD

The Colorado River Basin Salinity Control Act of June 24, 1974, (Public Law 93-320) provides for the enhancement and protection of the quality of water available in the Colorado River for use in the United States and Mexico. This 1983 Annual Report on the Colorado River Basin Salinity Control Program (CRBSCP) has been prepared to explain the progress, the activities, and the salinity control accomplishments achieved by the U.S. Department of Agriculture (USDA) program. USDA has continued to maintain reasonable progress with implementation of onfarm irrigation improvement and salinity control under authority of existing programs. However, USDA has proposed new legislative authorities and modest increases in funding for a separate Colorado River salinity control program within the Department. USDA feels that with broader authorities, the onfarm salinity control program can make substantial contributions in reducing overall salinity levels in the Colorado River for the benefit of the many downstream water users.

1983
USDA ANNUAL REPORT
COLORADO RIVER BASIN SALINITY CONTROL PROGRAM

I. INTRODUCTION

A. General

USDA involvement in the CRBSCP started in the early 1970's. As the United Sates and Mexico began to deal with the international problem of increased salinity concentrations in the Colorado River in the late 1960's, it became increasingly evident that much of the problem (and subsequently much of the solution) was associated with irrigated agricultural lands. Because of the extensive experience, knowledge, and technical expertise in agricultural irrigation, USDA's involvement in addressing the Colorado River salinity problems was natural. Initially, USDA participation was regarded more as consultive and supportive to the salinity control initiatives of USDI. As the causes of salinity problems became more defined and the solutions to salinity control were more clearly identified, it became obvious that onfarm agricultural salinity control would be very cost-effective, and a logical solution to solving a major part of the salinity problem.

B. The Colorado River Basin

The Colorado River Basin encompasses portions of seven States: Colorado, Wyoming, Utah, Nevada, New Mexico, California, and Arizona. (See Figure I-1.) The river is 1,400 miles long, with its headwaters in Wyoming and Colorado. It empties into the Gulf of California and serves some 14.5 million people on its way. It is one of the most physically developed and regulated rivers in the Nation. In 1964, the waters were totally consumed and flows no longer reached the Gulf of California.

The river flow is apportioned among Upper and Lower Basin States and the Republic of Mexico. There are some 2.6 million acres of private irrigated cropland and some 44 million acres of nonfederal forest and rangeland within the United States' portion of the Basin.

Because waters of the Colorado River serve as the primary life-line for much of the seven Basin States, there are many different uses for the Colorado River. Irrigation water is the major use; however, many municipal and industrial users are dependent upon Colorado River water. There are numerous hydro-electric power plants on the Colorado River. Therefore, the Colorado River goes through a continuous use and reuse cycle which involves irrigation, hydro-electric power, and municipal and industrial uses.

C. The Salinity Problem

Salinity problems in the arid and semiarid areas of the United States are a critical concern to those involved in the management of our natural resources. The salinity problem can take two forms. One is salinity buildup in the soil root zone that reduces or precludes an economic return from growing agricultural crops. The other is excessive salinity in groundwater, lakes, streams, and rivers that reduces or precludes their use for irrigation, domestic, municipal, and industrial water supply or for fish and wildlife habitat. Specialists agree that improved irrigation management, in most circumstances, offers an effective approach towards reducing the contribution to salinity in river systems from irrigation. Frequently, it is the most cost-effective option available.

Figure I-1

COLORADO RIVER BASIN

DRAINAGE & WATER USERS SERVICE AREA

As salinity concentrations increase, the damages and impacts become more severe. For irrigated agriculture, salinity levels of 500 to 700 milligrams per liter (mg/L) begin to have a detrimental impact on net returns. Higher salinity levels create increased operating costs, suppressed crop growth, and ultimately adversely affects yields. As salinity concentrations exceed 700 mg/L, the cross-section of salt tolerant crops becomes more restricted and limiting. Normally salt tolerant crops do not provide as favorable an economic return that the more salt sensitive crops do. Salinity levels in excess of 1000 to 2000 mg/L create severe crop production problems because of the need for specialized and extremely costly irrigation management practices.

With the maximum safe drinking standard set at 500 mg/L, salinity concentrations of over 500 mg/L also becomes costly for municipal, industrial, and residential homeowners to treat. The increased salinity concentration also has a corrosion and deteriorating effect on pipelines and home appliances.

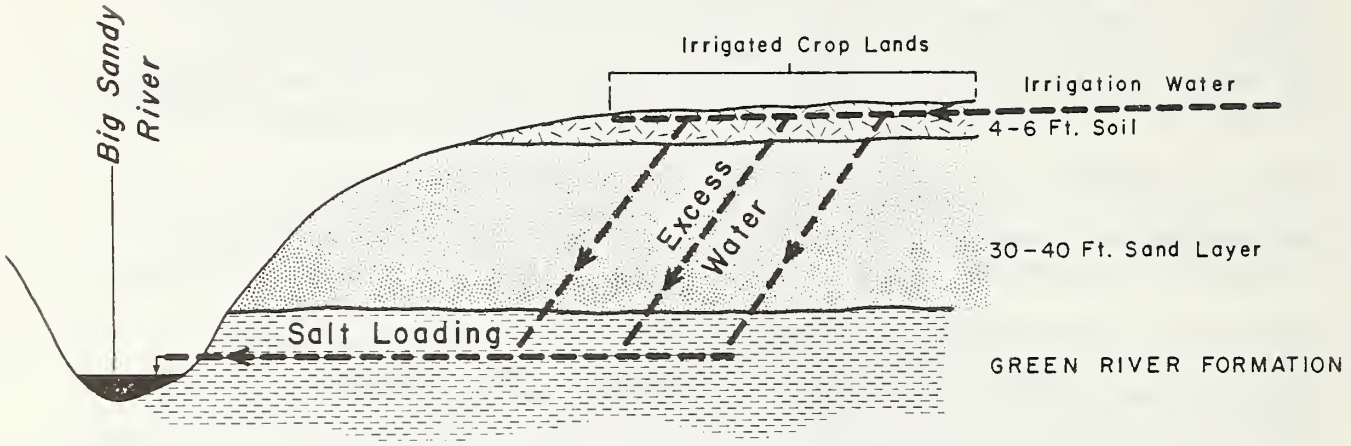
Within the Colorado River, increased salinity levels are caused by two different processes: 1) salt concentrating; and 2) salt loading. The "salt concentrating process" essentially involves the loss of waters by reservoir evaporation, export, and by evapo-transpiration of irrigated crops. As excess waters are evaporated and used by the plants, residual salts are left behind to concentrate in the soil and/or remaining waters. The "salt loading process" occurs as seepage and deep percolation dissolves mineral salts in the surface soils and highly saline geologic formations as it returns to the river system. As additional salts are picked up, the total salt burden or load carried by the river increases. Figure I-2 provides a good example of the salt loading process from over irrigation in the Big Sandy irrigated area.

In 1962, the salinity of the water delivered to Mexico increased from an annual average of about 800 mg/L to nearly 1,500 mg/L. This was primarily attributed to the highly saline drainage return flows from the Wellton-Mohawk Irrigation and Drainage District area, which empties into the Colorado River below Imperial Dam, and partially to the concentrating effects and salt loadings from upstream water development.

The total salt load in the river entering Lake Mead above Hoover Dam is estimated to average 9 million tons per year. To meet the salinity control objective of the Colorado River Basin Salinity Control Act, it is necessary to remove some 2 million tons of this salt load per year. The present average annual salinity concentration of the river varies from about 50 mg/L in the headwaters to about 732 mg/L at Imperial Dam. The USDI estimates future salinity level will reach about 1,000 mg/L at Imperial Dam for the year 2000 as additional upstream development takes place, assuming no corrective action is taken. Each mg/L increase in salinity concentration at Imperial Dam causes approximately $561,000 per year (1983 dollars) in economic damages to downstream agricultural, municipal, and industrial water users within the United States. It has been estimated that irrigation contributes about 37 percent of the total salt load to the river above Hoover Dam. Natural sources contribute 47 percent with reservoir evaporation (12 percent), exports (3 percent), and municipal and industrial use (1 percent) contributing the balance.

Average onfarm irrigation and distribution system efficiencies, especially in the Upper Basin, are generally low. Low irrigation efficiencies generally indicate high surface runoff and/or over irrigation. Over irrigation can

Figure I-2 The Salt Loading Process



SOURCE OF SALT LOADING

result in excessive deep percolation which leaches salts from the soil into the river. This greatly contributes to the salinity problem.

There are approximately 1 million acres of irrigated cropland in 17 identified salt sources units in the Colorado Basin. Ten of these units are presently considered feasible salinity control projects and would involve treatment on nearly 700,000 acres of irrigated cropland upon full implementation.

D. The Colorado River Basin Salinity Control Act

Salinity Control in the Colorado River Basin is addressed in the Colorado River Basin Salinity Control Act of 1974, Public Law 93-320. The Act has two major sections. Title I of the Act relates to maintaining the water quality (salinity concentrations) standards which the United States agreed to on August 30, 1973, in Minute 242 of the International Boundary and Water Commission for water delivered to Mexico under the Mexican Water Treaty of 1944. This section relates to a program for improving irrigation efficiencies and reducing highly saline irrigation drainage return flows from the Wellton-Mohawk Irrigation and Drainage District. Title I also authorizes the USDI to proceed with the design and construction of a large desalinization plant to treat excess irrigation drainage return flows from the Wellton-Mohawk area.

Title II of the Act deals specifically with the salinity concentrations in the Colorado River above Imperial Dam, and the controls necessary to meet United States water quality (salinity concentration) standards established by the seven basin States and the EPA. The Secretary of Interior was authorized

to undertake various investigations and studies to determine the nature of salt loading problems, potential salinity control solutions, and costs. The Secretary also received authorization to proceed with construction of certain salinity control projects.

More importantly, the Act instructed the Secretary of Interior "to coordinate and cooperate with the Secretary of Agriculture and the Administrator of the EPA" regarding diffuse and non-point source areas of salinity. Title II further instructed the Secretary of Agriculture to use "existing programs" available to that Department to assist with salinity control.

E. Benefits

Benefits related to water quantity, water quality, and reduced salt loadings are major factors in the onfarm salinity control projects. Completed reports indicate onfarm irrigation efficiency improvements and salinity control practices will reduce salt loads by 19,000 tons per year in Moapa Valley and by as much as 335,000 tons per year in Lower Gunnison. Table I-1 shows the salt load reductions and salinity concentration reduction impacts at Imperial Dam for six onfarm salinity control projects. USDA has not recommended a plan for the Big Sandy unit because of the continued off-farm salinity control investigations and studies being conducted by the Bureau of Reclamation (BR).

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The major benefits from the CRBSCP are international, national, and regional in scope. The international and national need is to maintain the salinity differential in the Colorado River water delivered to Mexico in accordance with the 1973 agreement (Minute No. 242 of the International Boundary and Water Commission, United States and Mexico). The regional need is to maintain current salinity levels in Colorado River water withdrawn for downstream use while allowing the Basin States to further develop its compact-apportioned waters.

II. INSTITUTIONAL AND INTERAGENCY COORDINATION

Under authority of Title II of the Colorado River Basin Salinity Control Act, an Advisory Council was created. The Advisory Council is composed of State representatives appointed by Governors of the seven Basin States. The Council is advisory only, and is established to act as liaison between USDI, USDA, EPA, and the Basin States.

USDI national program leadership has been delegated to the BR. To provide for interagency coordination, BR established a Federal Interagency Salinity Control Committee composed of all Federal agencies either participating or interested in the salinity control program. Other participants of this committee include: Bureau of Land Management (BLM), EPA, Fish and Wildlife Services (FWS), U.S. Geological Survey, ARS, and SCS. Major Federal interagency coordination has been achieved through this committee. The committee provides an opportunity to coordinate planning and implementation schedules, to surface and resolve technical and programmatic issues, and to provide for open communication and free flow exchange of information between the agencies.

Within USDA, the Secretary of Agriculture has designated SCS as lead agency responsible for the USDA coordination necessary to implement efficiently the provision of the Act. Within the scope of that responsibility, SCS has designated Mr. Edgar Nelson, Director, Basin and Area Planning Division, as the USDA Salinity Control Liaison Officer. A separate USDA Salinity Control Coordinating Committee provides for internal USDA coordination between ARS, ASCS, ES, CSRS, and SCS.

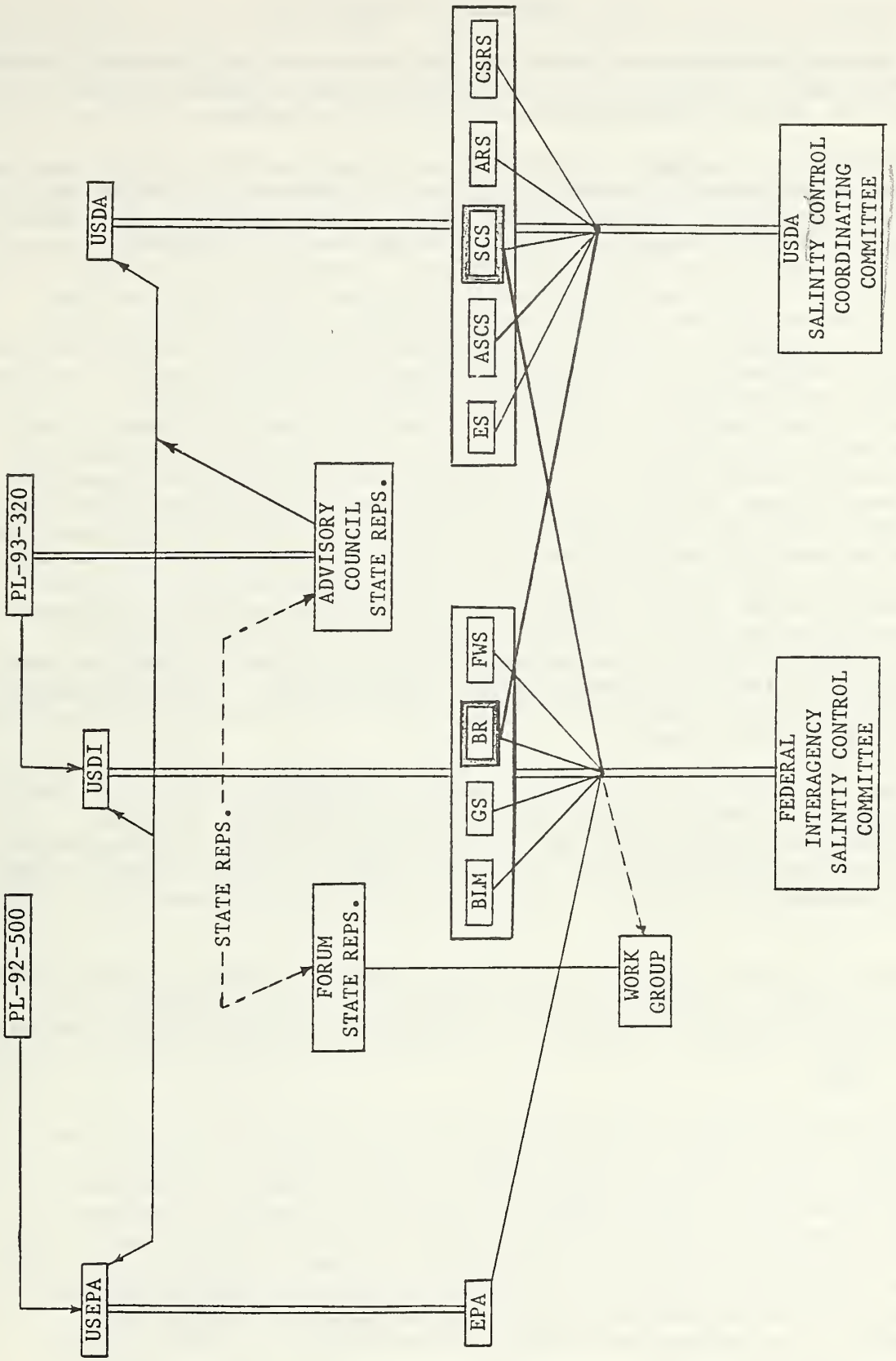
Another major group, the Colorado River Basin Salinity Control Forum, is also a key participant in the institutional and organizational structure of the program. The Forum was established by the seven Basin States in response to the Clean Water Act of 1977 (Public Law 92-500). The Forum was created by the States to provide a procedure for developing and reviewing water quality standards for the Colorado River as required in Section 303 of the Clean Water Act. In many cases, the same people are on both the Forum and the Advisory Council because both deal with water quality standards and numeric salinity standards for the Colorado River.

Created within the Forum is a technical "Work Group" to provide technical support and backup for the full Forum membership. In addition to Forum members, a number of Federal advisory representatives also serve on this "Work Group" including USBR, USGS, BLM, FWS, EPA and SCS. The "Work Group" essentially prepares working documents for consideration by the full Forum membership.

Figure II-1 provides a general illustration of the institutional and organizational structure in the CRBSCP.

Figure II-1

INSTITUTIONAL AND ORGANIZATIONAL STRUCTURE



III. Legislative Activities

USDA was very actively involved in legislative actions in 1983. With support and encouragement to the Colorado River Basin States, four different legislative proposals were introduced in the U.S. Congress.

Senator William Armstrong (D./Colorado) introduced S. 752. All fourteen basin state senators joined in co-sponsoring the bill on March 10, 1983. This bill was nearly identical to S. 2202 sponsored by Senator Armstrong in 1982 but not enacted in the 97th Congress. This bill would amend the Colorado River Salinity Control Act of 1974 (PL-93-320) and provides for an expanded and more comprehensive basin-wide salinity control program through USDI and USDA. For USDI, it authorizes new salinity projects for the Bureau of Reclamation, expands authorities for wildlife mitigations, establishes a cost-effectiveness basis for implementation, and exempts the salinity control program from the principles and standards in formulating water resources projects. S. 752 also authorized a separate USDA Colorado River salinity control program in which the Secretary of Agriculture is directed to: 1) identify irrigation salt source contributing areas; 2) investigate and develop published reports on salt source areas; 3) develop plans and implementation programs which identify salinity control practices, salt load reduction potential and estimated costs; 4) provide technical and cost-share assistance on installation of salinity control practices; 5) carry out research, demonstrations and educational activities; and 6) conduct monitoring and evaluation activities to assess progress in the program. S. 752 also provides for the reimbursement of certain USDI and USDA program implementation costs from the upper and lower Colorado River Basin development (power revenue) funds. This reimbursement provision serves to lower overall federal costs and to increase the nonfederal share from the basin states.

Hearings were held on S. 752 by the Senate Subcommittee on Water and Power of the Committee on Energy and Natural Resources on September 13, 1983. Mr. Richard D. Siegel, Deputy Assistant Secretary for Natural Resources and Environment testified favorably on behalf of USDA. Certain amendments were also suggested by Mr. Siegel. No further action has been taken on S. 752 in 1983.

A similar bill, H.R. 2790, was introduced by Rep. Ray Kogovsek (R/Colorado) on April 27, 1983. H.R. 2790 is nearly identical to S. 752 and H.R. 6790 introduced in the 97th Congress. It includes the same basic provisions for USDA and USDI. However, no hearings or legislative actions were taken on H.R. 2790 in 1983.

Legislation introduced in 1983 at the request of USDA in support of the Administration's fiscal year 1984 budget request includes S. 1842 and H.R. 3903. Because of the limitations and restrictions in using existing program authorities, USDA recommended legislation creating a separate Colorado River salinity control authority for the Secretary of Agriculture. S. 1842, introduced by Senator Armstrong of Colorado on September 14, 1983, amends PL-93-320 and essentially includes the same authorizing language for USDA as would be included in S. 752 with the suggested Departmental amendments. No Congressional action has been taken on S. 1842 in 1983.

H.R. 3903 was introduced by Representative Kika de la Garza (D/Texas) on September 15, 1983. Hearings were held on September 20, 1983 before the House Subcommittee on Conservation, Credit, and Rural Development of the Committee

on Agriculture. Mr. Siegel again provided favorable testimony on behalf of the Administration and the Department. The bill was acted upon favorably and moved to the full House floor where H.R. 3903 was passed on November 18, 1983. H.R. 3903 has been referred to the U.S. Senate and awaits further action in the Senate Committee on Agriculture, Nutrition, and Forestry.

While H.R. 3903 is very similar to the agricultural components of S. 1842, S. 752 and H.R. 2790, it differs from these bills because it does not amend PL-93-320. Instead, H.R. 3903 provides its own separate and free standing legislative authorization for a USDA Colorado River salinity control program.

IV. FUNDING AND BUDGETING

For FY 1984, USDA developed a proposal for a consolidated account to cover the USDA CRBSCP. With the support and concurrence of the Under Secretary for International Affairs and Commodity Programs and the Assistant Secretary for Natural Resources and Environment, ASCS and SCS took the leadership to develop a fully coordinated budget package. Included within the consolidated account are funds for ASCS, SCS, and ES. The funds will provide for cost-sharing, technical assistance, salinity studies, monitoring, and extension education support. Research funding for ARS and CSRS were not included in the consolidated account at this time.

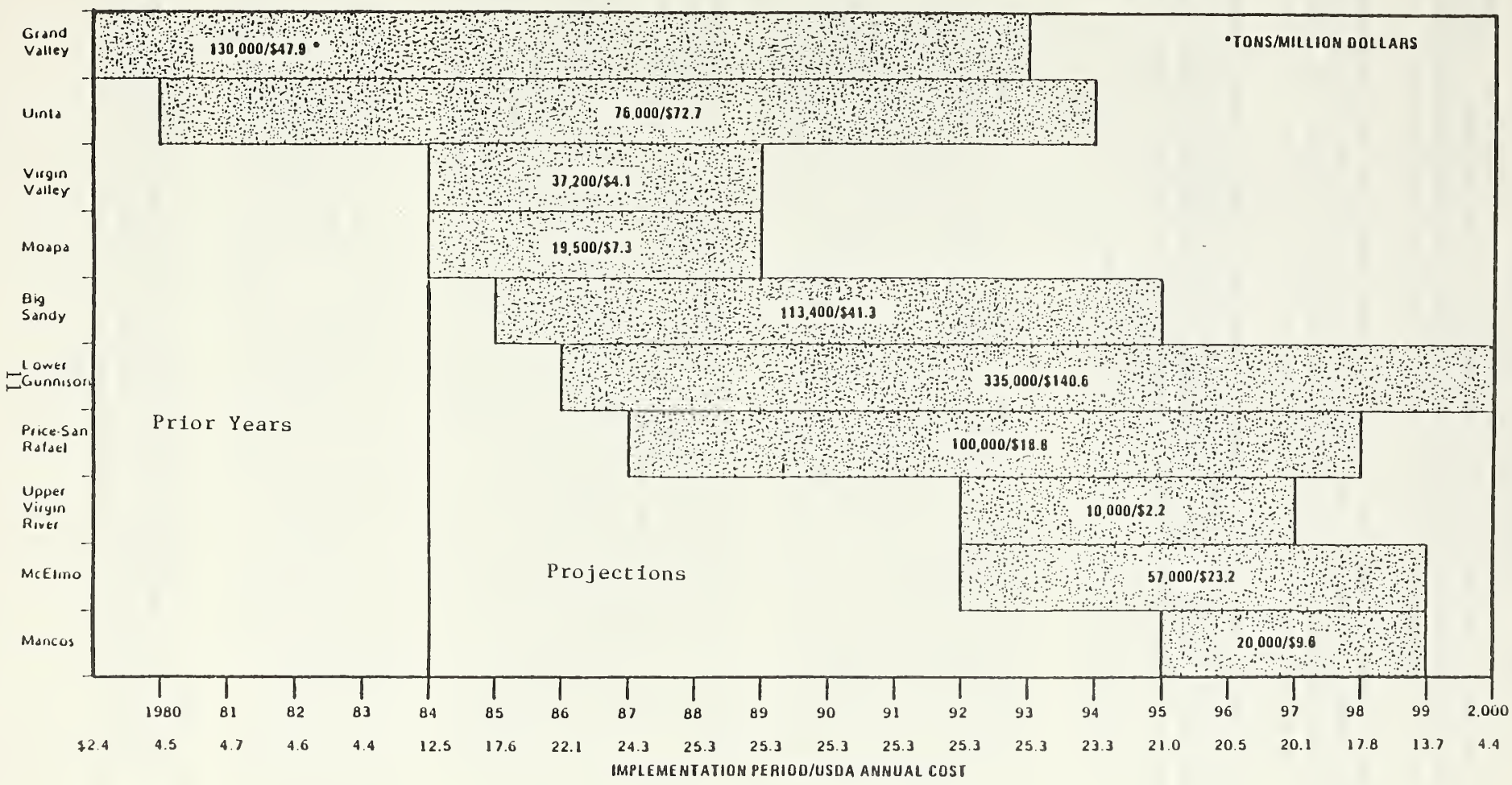
A component of the FY-84 budget was a "modified" USDA CRBSCP implementation schedule. This modified implementation schedule presents a more gradual and realistic transition into full scale implementation of the various USDA onfarm salinity control projects. Figure IV-1 identifies the proposed projects and present implementation schedule for onfarm salinity controls. While this schedule may be changed, and is, of course, subject to Congressional funding, USDA feels that through this schedule the Colorado River salinity control objectives and water quality standards can still be achieved while States continue to more fully develop their compact-apportioned water supplies.

The consolidated budget, to be incorporated into the ASCS budget package, is proposed in lieu of submitting separate and individual budget requests in each agency. This budgeting approach allowed the various USDA agencies to coordinate their requests and to better present an overall budget picture. The general agency breakdown for requested FY 1984 funding levels are as follows:

	FY-83 Actual	FY-84 Request	Change Over FY-83
ASCS			
Cost sharing	4.0	10.0	+6.0
SCS			
Technical assistance	0.6	1.5	+0.9
Monitoring and evaluation	0.4	0.7	+0.3
Planning studies	0	0.15	+0.15
ES			
Educational assistance	0	0.2	+0.2
TOTAL	5.0	12.55	+7.55

In conjunction with the budget request, USDA also submitted appropriate authorizing legislation for the creation of a separate program. The legislation was subsequently introduced as S. 1842 and H.R. 3903. Either of these bills would have provided the necessary authorization, but they were not acted upon. Because authorizing legislation had not been enacted, the Congressional appropriation committees would not honor the Administration's budget request. As a result, the two ongoing salinity control projects continued to be funded at a much lower level through the Agricultural Conservation Program of ASCS and the SCS conservation technical assistance program. In addition to the loss of proposed funding increases, SCS planning activities and the Extension Service education programs for salinity control were not funded in FY 1984.

USDA
COLORADO RIVER BASIN SALINITY CONTROL PROGRAM
Cost, Implementation Schedule, and Salt Reduction Upon Completion



Total Salt Reduction = 898,000 Tons Per Year
Total Cost = $369.7 Million (Includes $2.0 Million for Basin Studies)
Total Economic Benefit = $529.8 Million Per Year

Figure IV-1

The FY 1984 budget would have essentially doubled the implementation effort for the Grand Valley and Uinta Basin projects. It would have allowed two new units, the MOAPA and Virgin Valley in Nevada, to be started. The funding increases would have also expanded monitoring, increased educational assistance, and expanded salinity control studies in other units.

A similar budget package for FY 1985 has been submitted by USDA and the Administration. Hopefully sufficient legislative action will be completed to enable the Congressional appropriation committees to more fully fund the overall program.

The Agricultural Research Service continues to be funded at approximately $1,000,000 per year for expanded salinity control research. While CSRS must continue to rely upon state-level funding and the support of land grant colleges and agricultural experiment stations for salinity research funding.

V. USDA TITLE I ACTIVITIES

USDA activities under Title I of the Colorado River Salinity Control Act are primarily related to improving irrigation efficiencies, reducing deep percolation, and reducing highly saline irrigation and drainage return flows from the 65,000 acre Wellton-Mohawk Irrigation and Drainage District in Yuma County, Arizona. As farmers over-irrigate, excess and unused irrigation waters percolate down through the soil profile creating a high water table enriched with high salinity levels. To overcome the agricultural production problems caused by salinity build-up and poor drainage, pump-drainage wells are used to lower the saline high water tables. This "pumped" drainage water, with salinity concentrations ranging from 3,000 to 6,000 parts per million (PPM), is then removed from the Wellton-Mohawk area through drainage canals and ditches discharging into the Colorado River. These highly saline return flows then cause increased salinity concentrations in the Colorado River waters delivered to Mexico. This highly saline drainage return flow created the downstream salinity problems for Mexico in the 1960's which led to Minute No. 242, and the passage of Public Law 93-320, the Colorado River Basin Salinity Control Act of 1974.

In conjunction with the BR planning for the desalting plant authorized in Title I of the Act, an Advisory Committee on Irrigation Efficiency and a support Technical Field Committee on Irrigation Efficiency were created. These interagency committees were formed to develop alternatives to improve irrigation efficiencies and to reduce drainage return flows. This would ultimately reduce the size and costs of building and operating a large desalting plant. A 1974 "Special Report: Measures for Reducing Return Flows from the Wellton-Mohawk Irrigation and Drainage District" includes the specific recommendations for installing onfarm measures and technical assistance.

The recommended onfarm program essentially included structural onfarm improvement measures, technical assistance through SCS, and Federal cost-share through individual conservation plans and long-term contracts. The initial program established in 1974 included irrigation system improvements and water management on 23,800 acres in a five-year period. Recommended cost-sharing was established at 75 percent Federal and 25 percent landowner or farm operator. The combined impact of the USDA onfarm program, the BR Irrigation Management Scheduling program, and the BR 10,000 acre acreage reduction program were projected to increase district-wide irrigation efficiencies from 55 percent up to 72 percent. Drainage return flows were also projected to be reduced from approximately 200,000 acre-feet per year down to 136,000 acre-feet.

In 1979, the Technical Field Committee on Irrigation Efficiencies recommended the onfarm program be expanded to include treatment on an additional 19,000 acres with all other irrigation lands being eligible for a water management plan. The Advisory Committee's recommended implementation program to improve onfarm irrigation efficiencies will further reduce return flows to 108,000 acre-feet per year. The implementation program is scheduled to continue through 1986.

The Wellton-Mohawk onfarm program is fully funded by the BR. Under authority of the USDI and USDA Memorandum of Understanding (November 1974) and a BR-SCS Title I Memorandum of Agreement (December 1974), the BR periodically reimburses the SCS for cost-sharing expenditures and technical assistance

costs. The SCS enters into direct landowner or operator contracts to install conservation practices that contribute directly to the objectives of the program. The contract is based upon irrigation water management plans developed with SCS technical planning assistance. The contract provides for technical and cost-share assistance on design and installation of water management practices. There are provisions for irrigation water management efficiency compliance checks over a two-year period following installation of practices.

The SCS establishes planning and implementation priorities to more effectively use the resources allocated to the program. Priorities are established by considering current irrigation efficiencies, crops grown, adequacy of onfarm systems, and soil characteristics. Lands with greatest potential for increasing efficiencies and decreasing drainage return flows receive highest priorities. All plans and SCS contracts are reviewed and approved by the governing Board of Supervisors for the Wellton-Mohawk Valley Natural Resource Conservation District.

As of 1983, 347 applications for assistance over 53,000 acres were received. Irrigation water management plans and contracts have been developed on 259 farms covering 36,170 acres. Of these, 27,200 acres have been fully treated and are presently under a continuing irrigation water management program.

In 1983, 24 plans were developed and contracts signed on 3,265 acres. All land treatment and water management improvement practices for salinity control were applied to 5,215 acres in 1983. Technical assistance for continued irrigation water management will be provided on these acres over the next two years as part of the followup program.

Table V-1 presents a summary of 1983 accomplishments and the total practices installed to date.

Table V-1

Practices Installed
SCS Onfarm Improvement Program
Wellton-Mohawk Irrigation and Drainage District

PRACTICES		1982	CUMULATIVE
1. Ditch Lining	(Ft)	101,273	978,554
2. Land Leveling	(Ac)	3,564	32,458
3. Structures for Water Control and Measurement	(No)	558	8.570
4. Soil Improvement	(Ac)	127	1,997
5. Vertical Underground Barriers	(Ft)	1,312	15,817

VI. USDA TITLE II ACTIVITIES

Title II activities include a broad range of USDA agencies in the planning and implementation of an agricultural onfarm salinity control program.

Specific language in Title II of Public Law 93-320, the Colorado River Basin Salinity Control Act, directed the Secretary of Interior, the Administrator of the EPA, and the Secretary of Agriculture to "cooperate and coordinate their activities effectively to carry out the objectives of this title." The major program areas addressed by the USDA agencies are: 1) irrigation salt source area studies (SCS); 2) implementation technical assistance (SCS); 3) implementation cost-sharing (ASCS); 4) extension education (ES); 5) research and demonstration (ARS, CSRS); and 6) monitoring and evaluation (SCS).

A. Irrigation Salt Source Area Studies

This activity is a planning function under leadership of SCS. The objectives of these studies are: 1) to identify salt source areas; 2) to determine salt loading estimates; 3) to evaluate treatment alternatives and salt load reduction impacts; and 4) to develop recommended implementation plans and associated implementation costs. These detailed salinity control studies and investigations are being funded using river basin study authorities of Section 6 of Public Law 83-566. Full coordination is maintained with the BR, the EPA, and interested State and local agencies or organizations through various coordinating committees at the local project level.

Table VI-1 presents the current status of the 17 identified irrigation salt source area studies. With publication of the Virgin Valley and McElmo Creek reports, USDA has completed seven salinity control studies on over 500,000 acres. If the six units with recommended plans were fully funded and implemented, they would reduce Colorado River salt loading by nearly 735,000 tons per year which translates into a reduction in salinity concentrations at Imperial Dam of 79 mg/L.

Salinity control planning activities for FY-84 will be somewhat minimal with only modest planning activities underway in the Price-San Rafael (UT) and the scheduled completion of Mancos Valley (CO). USDA anticipates adequate funding to resume a more intensive planning effort in FY-85. Other salt source areas with no anticipated study activities at this time either lack significant salinity control benefits or local support to initiate a planning study.

B. Implementation Technical Assistance and Cost-Sharing

In Public Law 93-320, the Secretary of Agriculture was directed "to cooperate in the planning and construction of onfarm system measures under programs available to that Department." Present USDA implementation projects are being carried out under authority of the existing SCS conservation technical assistance program and the ASCS Agricultural Conservation Program (ACP) cost-sharing authorities.

Colorado River Basin Salinity Control Program
Irrigation Salt Source Unit Studies
Status Report

Area	Study Status	Impl. Start	Remarks
1. Grand Valley (CO)	Publ. - Dec. 1977	1979	Modified schedule extends implementation to 1993
2. Uinta Basin (UT)	Publ. - Jan. 1979	1980	Modified schedule extends implementation to 1994
3. Big Sandy (WY)	Publ. - Nov. 1980	1986	USBR off-farm and USDA onfarm alternatives being reassessed in conjunction with State of Wyoming
4. Moapa Valley (NV)	Publ. - Feb. 1981	1985	Pending implementation funding in FY-85
5. Lower Gunnison (CO)	Publ. - Sept. 1981	1987	Proposed to rescope implementation plan with priority areas and implementation phases
6. Virgin Valley (NV, AZ)	Publ. - March 1982	1985	Pending implementation funding in FY-85
7. McElmo Creek (CO)	Publ. - Jan. 1983	1992	Implementation extended to future years
8. Price-San Rafael (UT)	Underway-Scheduled 1984	1987	Maintain USBR liaison in FY-84, draft report prepared
9. Upper Virgin (UT)	Temporary Suspension	1992	Study activities to resume pending funding in FY-85
10. Mancos Valley (CO)	Underway-Scheduled 1984	1995	Draft Report complete. Implementation extended to 1995 - subject to change
11. Little Colorado River (CO)	Publ. - Dec. 1981	--	No recommended plan or salinity control benefits identified
12. Colorado River Indian Reservation (AZ)	Underway-Scheduled 1984	--	General river basin study underway, no major salinity control benefits or implementation anticipated
13. Palo Verde (CA)	Inactive	--	Anticipate USDA & USBR planning activities for FY-85.
14. Dirty Devil (UT)	Inactive	--	No anticipated activities at this time
15. Roaring Fork (CO)	Inactive	--	No anticipated activities at this time
16. Henry's Fork (WY)	Inactive	--	No anticipated activities at this time
17. Lyman (WY)	Inactive	--	No anticipated activities at this time

The SCS provides program leadership for technical assistance to individual landowners and operators. Major services that the SCS provides include assisting landowners in developing irrigation water management and salinity control plans, designing and installing irrigation improvement practices, and subsequent water management followup assistance with individual irrigators to improve irrigation application techniques and assure proper maintenance.

There also needs to be significant incentive for individual landowners to invest in sophisticated water management systems which essentially provide for off-site benefits to downstream users. Because of the significant off-site or downstream benefits, a reasonable level of cost-sharing support is needed to encourage local landowners to participate. Using existing ACP authorities, the ASCS provides cost-sharing for the installation of water management practices and related off-farm lateral distribution systems. Cost-sharing may be provided through annual practices or through long-term agreements (contracts) based upon complete onfarm water management and salinity control plans.

Grand Valley, Colorado

The Grand Valley project was initiated in 1979 as the first onfarm salinity control project in USDA. The implementation program is tailored to the USDA salinity control report, "Onfarm Program for Salinity Control, Final Report of the Grand Valley Salinity Study," dated December 1977, and Supplement No. 1 issued in March 1980.

The initial plan called for the treatment of approximately 53,000 acres with such things as: 1) irrigation system improvements like concrete lining, pipelines, gated pipe, measuring devices and water control structures; 2) land leveling for more uniform irrigation application; and 3) irrigation water management practices such as regulating the length of run, time of set, flow rates, and frequency of irrigation necessary to reduce deep percolation.

Supplement No. 1 also included provisions for limited improvements of off-farm lateral distribution systems which are important to the delivery of irrigation water to the onfarm irrigation systems. The design and construction of off-farm laterals are an integral part of the onfarm improvement program. Improvements and redesign of more efficient off-farm delivery systems have to be compatible with the location, elevation, and flow rates for onfarm irrigation systems.

When fully implemented, the onfarm improvement program and associated lateral work is estimated to reduce Colorado River salt loadings by 230,000 tons per year.

In 1982, SCS created an irrigation water management (IWM) specialist position to devote more attention to the onfarm IWM followup program. As irrigation systems are improved, it become extremely critical that the farm operator (or irrigator) improve his irrigation techniques and minimize deep percolation to fully achieve the salt load reduction objectives of the program. It is the continued operation and maintenance of onfarm irrigation systems and improved irrigation water management which work toward reducing deep percolation and subsequently reduced salt loads to the Colorado River.

Under the ACP Program, ASCS received 316 individual requests in 1983. Since 1979, over 1,600 separate requests for cost-share assistance have been received with nearly 1,200 participants actually completing an irrigation water management and salinity control practice. While the project relies heavily on annual ACP requests and practices, there have been 15 long-term agreements (LTA's) on 2,241 acres developed since 1979. Three LTA contracts on 219 acres were completed in 1983. SCS has also assisted in the development of 50 IWM plans on 2,263 acres in 1983, bringing the total number of IWM plans to 245 on 7,736 acres. Actual IWM/salinity control practices applied in 1983 and cumulative to date accomplishments are presented in Table VI-2.

Table VI-2

Grand Valley Irrigation Water Management
& Salinity Control Practices Applied

Practices	Unit	1983 1/	Cumulative
Off-farm Related Laterals			
Pipeline	Ft.	21,031	157,549
Ditch Lining	Ft.	780	57,021
Structures	No.	40	107
Onfarm Improvements			
Pipeline	Ft.	73,450	292,734
Ditch Lining	Ft.	35,793	220,066
Gated Pipe	Ft.	71,570	186,515
Land Leveling	Ac.	272	2,054
Drip/Sprinkler Systems	No.	--	8

1/ 1983 Fiscal Year

The cumulative impacts of these practices and improved irrigation water management represent a 4,655 acre feet reduction in deep percolation per year with an equivalent salt load reduction of 23,300 tons per year. This salt load reduction translates into a 2.43 mg/L reduction in salinity concentrations at Imperial Dam.

Uinta Basin, Utah

The Uinta Basin salinity control project, initiated in 1980, is the second and only other Title II USDA onfarm program underway at this time. The project is being implemented consistent with "USDA Salinity Report, Uinta Basin Unit, Utah" published January 1979 and supplemented by a November 1980 Addendum. The implementation plan includes the installation of sprinkler systems on 79,000 acres and improved surface irrigation systems on 43,000 acres. Other associated water management practices are included in the land treatment phases of the project for salinity control. The total estimated salt load reduction estimates for the fully implemented Uinta Basin report is 76,600 tons per year.

The implementation strategy for the Uinta Basin was to target salinity control planning and application to priority areas within the project. The initial USDA salinity control study looked at nine different evaluation units and treated each area as a separate subunit to the entire Uinta Basin. As implementation started in 1980, the Dry Gulch area was identified for priority assistance. Since then implementation focus has been expanded to the Pelican Lake area. This feature has provided for much higher visibility and localized impacts at the project level.

A second feature to the Uinta Basin implementation strategy included the use of complete IWM and salinity control plans as a basis for USDA cost-sharing through LTA's. The LTA approach provides for a more substantial commitment on behalf of the farmers and USDA, as well as providing assurance that long-term cost-share provisions will be available for the life of the agreement. This allows for more comprehensive and effective onfarm planning and application. There are also annual cost-share provisions for those landowners who do not wish to participate in the LTA program. Pooling agreements with groups of landowners are also key features to project implementation through the ACP program.

Under the LTA phase of the program, 168 applications covering 23,720 acres were received in 1983. This makes a total of 433 applications on 61,590 acres since this project started. Plans have been developed and contracts formalized for 108 participants on 8,208 acres in 1983. Since 1980, this makes a total of 294 LTA contracts on 22,279 acres. This represents approximately 50 percent of the total applications received to date.

Table VI-3 presents a summary of the practices applied in the Uinta Basin. The cumulative effects of these practices has served to raise irrigation efficiencies on about 7,850 acres from an average of 30 percent "before" to approximately 55 percent "after" practices were applied and maximum IWM has been achieved. This results in an estimated 7,950 acre feet per year reduction in deep percolation and an annual salt load reduction of 26,400 tons for the project. At Imperial Dam, this salt load reduction translates into a 2.75 mg/L reduction in Colorado River salinity concentration.

Table VI-3

Uinta Basin Irrigation Water Management
& Salinity Control Practices Applied

Practices	Units	1983	Cumulative
Pipeline	Ft.	255,993	893,976
Sideroll Sprinkler	Ft.	38,663	149,984
Pivot Sprinkler	Ft.	2,625	11,182
Gated Pipe	Ft.	47,942	110,559
Reg. Reservoir	Ea.	0	18
Pump & Motor	Ea.	0	43
Land Leveling	Ac.	215	514
Irrigation Water Management	Ac.	6,378	7,849

C. Extension Education

The ES is using general appropriation funds to conduct demonstration, information, and education programs. Extension specialists conduct water management workshops and other educational programs for farmers, technicians, county agents, and personnel of agricultural service and supply firms. Extension specialists also work with farmers in fine tuning irrigation practices to improve the irrigation efficiency and economy of operations. The ES, through the State Cooperative Extension Service (CES) in Utah and Colorado, has continued to provide this extension education support.

In the Grand Valley, the ES worked with the BR and the Colorado CES to develop a special extension education effort to assist both the BR canal and lateral lining activities and the USDA onfarm program. Through Memoranda of Understanding and working cooperative agreements, the Colorado CES has provided a full time extension specialist to assist in the Grand Valley project area. Major activities include working with landowners and irrigators to more formally organize working groups on the many irrigation distribution laterals. Funds to support this education effort are being provided by the BR to Colorado CES through a reimbursable agreement with ES. Funding will continue through FY-84 for this extension education support at which time USDA and the Colorado CES will be expected to fund the position.

D. Research and Demonstration

USDA research and demonstration activities are vital to the development of new and improved water management practices for control of soil and water salinity. Scientists at four ARS locations are involved in this coordinated effort: Riverside, California; Fort Collins, Colorado; Phoenix, Arizona; and Kimberly, Idaho. Scientists at the U.S. Salinity Lab at Riverside are conducting a cooperative isotope study in the Grand Valley to determine the origin of seepage water and quantity from various sources. A systems engineer has been added to the staff at the Lab to begin integrating salinity control concepts and practices into a predictive-management model. The drainwater reuse project in the Imperial Valley, which was initiated in 1982 and described in the 1982 annual report, has shown no reduction in crop yields when drainwater with 3,000 mg/L water has been substituted for more than one half of the irrigation water. A lysimeter study has been initiated at

Riverside to simulate conditions at two reuse test sites to enable evaluating in more detail the changes that occur in soil salinity and to provide validation data to test a computer model. Studies have been initiated to develop automated soil salinity mapping techniques for use in monitoring changes in soil salinity, diagnosing soil salinity problems and providing data for other irrigation-related management decisions. A new technique has been developed for simultaneously measuring soil water content and electrical conductivity with a single probe. This technique, which is known as Time Domain Reflectometry, when used with known relationships between soil and soil water conductivity, will provide both soil water content and soil water salinity from a single measurement. Scientists at Fort Collins have used weighing lysimeters with shallow water tables of different salinities for three years to measure the extraction of saline water by crops. The purpose of these studies is to determine how much water at different salinities crops can be expected to extract from the saturated zone so that irrigation schedules can be adjusted and excess water applied reduced. For corn, the irrigation water required for a deep water table was about twice as great as for a water table at a depth of 0.6 meter. The rate of groundwater use was only slightly affected by salinity. With the water table at 0.6 meter, alfalfa used one-third as much saline groundwater as non-saline water. Studies are being conducted in the Grand Junction area to develop coefficients for infiltration equations to enable more accurate prediction of furrow infiltration rates for soils in the project. A new device for automating alfalfa valves has been developed which leaves the valve closed if control pressure is lost.

Engineers at Phoenix have developed an accurate open channel flow monitoring system. This system has been evaluated in an Arizona study to monitor irrigation delivery rates and volumes. The study showed that the variability in the flow rate was affected by turnout locations within a distribution system, but not by time of year, average flow rate and crops irrigated. These results and monitoring techniques will be used to develop improved water delivery practices needed to control salinity in the Colorado River Basin.

Scientists at Kimberly have installed automated surface irrigation systems in the Grand Valley and Uinta Basin in cooperation with farmers and the SCS to evaluate their suitability and benefits and to develop operating and maintenance procedures and criteria. In the Uinta Basin, a cablegation system was installed on a graded border system in cooperation with a farmer and the SCS to evaluate its feasibility for reducing deep percolation at the upper ends of borders that have high infiltration rates. In the Grand Valley, an 8-hectare system was installed on soil that had been cut exposing the shale. This system will enable light frequent irrigations so as to reduce deep percolation and will be evaluated in 1984.

Studies are also underway on methods of increasing the intake rates in furrows at the lower ends of fields. This part of the field normally is under-irrigated unless excessive irrigations are used. Rate of wetting was found to affect aggregate stability and infiltration rates of Grand Valley soils. Surge irrigation, which can be achieved with cablegation and other automated systems, has been shown to improve water application uniformity in furrow-irrigated fields.

E. Monitoring and Evaluation

Monitoring and evaluation (M&E) activities have been extremely limited since initiation of the Uinta Basin and Grand Valley projects. However, in 1983 SCS completed long-term monitoring plans from the Uinta Basin and Grand Valley projects and began installation of data collection equipment in the Uinta Basin.

The long-term monitoring plans were developed to provide a basis for staffing and funding monitoring activities to evaluate program implementation impacts on water management, deep percolation, and salt load reductions. The monitoring plans are designed to evaluate a cross-section of various onfarm irrigation systems and will serve as a basis to more accurately determine project impacts. Major components of the plans include onfarm irrigation evaluations, wetland and wildlife habitat evaluations, data collection and analyses, plus an economic evaluation component which will be added later.

In 1983, SCS provided an additional $400,000 of national inventory and monitoring funds to initiate the monitoring and evaluation programs in the Uinta Basin and Grand Valley. Approximately $200,000 was allotted to each project for the purchase and installation of monitoring equipment, and for staffing specific monitoring and evaluation teams.

A major component of the monitoring plan is the installation and use of an automated data collection site called "Popcorn" (trade name). The use of Popcorn data collection sites is a new endeavor by SCS to expand the SNOTEL (Snow Telementry) data collection system. Essentially, the "Popcorn" site field installation will be used to automatically collect field data to be transmitted via telecommunication to the SNOTEL remote sensing network. The SNOTEL network, presently used for snow surveys and water (snow-melt) forecasting in the West, then transmits field data to computer access terminals where data can be recorded, stored, processed and analyzed.

The Popcorn site will collect data which influence evapotranspiration rates used in irrigation scheduling. The unit will collect and transmit hourly readings on wind run, solar radiation, precipitation, daily maximum-minimum-mean temperature, humidity, soil moisture, and soil temperature. Instrumentation of flow measuring devices installed on monitoring farms will also be a part of the automated data collection process. The information collected through the Popcorn site will be used as a part of the monitoring program and will also be used to assist with better irrigation scheduling.

In 1982, the first Popcorn site was installed in the Uinta Basin. Because the project area covers such a large and complex geographical area, a second site was installed in 1983. The first Popcorn site to be installed in Grand Valley was completed in late 1983.

Monitoring and evaluation teams are being established in both project areas and team leaders are now in place. However, due to limited FY 1984 funding, the full complement of technical specialist on the monitoring teams will not be achieved in 1984.

Some basic data collection activities and field experience was gained in 1983 and will be expanded in 1984. Approximately 3-5 monitoring farms have been identified in each unit and the initial onfarm monitoring efforts are underway.

The M&E plans have been developed with a broad cross-section of State and Federal interagency inputs. The activities are coordinated with other agencies to avoid duplication and to assure that the data collection and analysis will be complementary to the monitoring efforts of others.

VII. PROJECTED 1984 ACTIVITIES

USDA will continue to be involved with many of the same activities in 1984 as in previous years; however, some new and expanded initiatives will be undertaken.

Continued activities will include a limited amount of salinity control planning in two irrigation salt source areas. Continued followup in the Price-San Rafael (UT) study and completion of the Mancos Valley (CO) study is scheduled. Implementation of the Wellton-Mohawk Title I project and the Grand Valley and Uinta Basin Title II projects will be continued at approximately the same level of intensity. Extension education support will also be continued.

The expanded salinity control research program through ARS will be continued. This activity is very important for the continued development and advancement of new irrigation water management and salinity control technology.

Implementation of a long term monitoring and evaluation plan will be further expanded in 1984. The monitoring plans, staff and funding needs, as well as equipment needs have been developed and partially funded. SCS proposes to expand this monitoring effort during the 1984 irrigation season. The entire monitoring program is scheduled to be fully implemented by 1985 provided sufficient funds are available.

Legislative activities will also be prompting some new USDA CRBSCP initiatives. USDA will continue to seek appropriate legislative authority for an expanded onfarm Colorado River salinity control program. In addition, specific program rules and regulations for implementing the program will be developed following the passage of authorizing legislation.